ON INSTITUTIONAL DYSENTERY.

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A STUDY OF THE DYSENTERY OCCURRING AT THE COOK COUNTY INSTITUTIONS AT DUNNING, ILL., IN 1910.*

Dysentery has been endemic in the Cook County Institutions at Dunning for a number of years. The report of this investigation, which was suggested by Dr. Hektoen, concerns etiology, diagnosis, and therapy.

I. ETIOLOGY.

The etiology of asylum dysentery has been investigated in many instances in this and in other countries. In most cases the dysentery was found to be of the bacillary type. The cases reported by Vedder and Duval[1] were mostly due to the Flexner type of bacilli, only a few Shiga bacillus cases being found. Fisher, in an epidemic at the Middletown Hospital for the Insane,[2] found only bacilli of the Flexner type. In an epidemic at the Danvers State Hospital, Danvers, Massachusetts,[3] bacilli of the Shiga type predominated. Only a few cases due to the Flexner bacillus were found.

The dysentery bacilli are classified, according to their properties of sugar fermentation, into mannite fermenters and non-mannite fermenters. The Shiga bacillus represents the non-fermenters, and the bacilli which ferment mannite are divided into (1) the Flexner-Harris type, which ferments maltose but not saccharose, (2) the Hiss Y type, fermenting neither maltose nor saccharose, (3) the Strong type, which ferments maltose but not saccharose. These types may also be distinguished from each other by agglutination tests.

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[1] Vedder and Duval, *Jour. Exper. Med.*, 1902, 6, p. 181.

[2] MacConkey and Hill, *Thompson Yates Laboratory Reports*, 1901, 4, p. 160.

[3] E. T. F. Richards, *Boston Med. and Surg. Jour.*, 1909, 161, p. 679.

A search was made in a number of the cases of diarrhea occurring in the institution as follows:

The stools were transferred to sterile test-tubes and taken to the laboratory. They were plated within a few hours after passage. Particles of mucus were selected for examination and washed in two changes of sterile salt solution or broth. The mucus was then shaken in a small quantity of broth until thoroughly disintegrated, and, by means of a platinum spatula, different dilutions of this mixture were smeared

TABLE 1.

Case Number	Motility	Gram Stain	Lactose Acid	Glucose Gas	Mannite Acid	Whey 24 hrs. Acid	Whey 48 hrs. Acid	Milk Coagulation	Cultural Characters of
1....	−	−	−	−	−	−	+	−	Shiga bacillus
2a...	−	−	−	−	+	+	Alk.	−	Flexner "
2b...	−	−	−	−	−	−	−	−	Shiga "
3....	Negative								
4....	−	−	−	−	−	+	+	−	Shiga "
5....	Negative								
6....	Negative								
7....	−	−	−	−	−	?	+	−	Shiga "
8....	−	−	−	−	+	+	Alk.	..	Flexner "
9....	−	−	−	−	−	+	+	−	Shiga "
10....	Negative								
11a...	+	−	−	+	+	+	+	−	?
11b...	−	−	−	−	−	−	−	−	Shiga "
12....	−	−	−	−	−	−	−	−	Shiga "
13 ...	−	−	−	−	+	−	−	−	Flexner "
13 ...	?	−	−	−	−	−	+	−	Shiga "
14....	−	−	−	−	−	−	−	−	Shiga "
15....	−	−	−	−	−	−	−	−	Shiga "
16....	−	−	−	−	−	−	+	−	Shiga "
17....	−	−	−	−	−	+	+	−	Shiga "
18....	−	−	−	−	−	−	+	−	Shiga "
19....	−	−	−	−	+	+	Alk.	−	Flexner "
20....	−	−	−	−	+	+	Alk.	−	Flexner "
21....	−	−	−	−	−	−	−	−	Shiga "
22....	−	−	−	−	−	−	−	−	Shiga "
23....	−	−	−	−	−	+	+	−	Shiga "
24....	−	−	−	−	+	+	Alk.	−	Flexner "
25....	−	−	−	−	−	−	−	−	Shiga "
26....	Pyocyaneus								
27....	−	−	−	−	+	+	Alk.	−	Flexner "
28....	−	−	−	−	−	−	−	−	Shiga "
29....	−	−	−	−	−	+	+	−	Shiga "
30....	Negative								
31....	−	−	−	−	−	+	+	−	Shiga "
32....	−	−	−	−	+	+	Alk.	−	Flexner "
33....	−	−	−	−	−	+	+	−	Shiga "
34....	−	−	−	−	−	−	−	−	Shiga "
35–36.	Negative								

over the surface of dextrose free litmus lactose agar plates. At the end of from 18 to 48 hours, subcultures were made from colonies which had not produced acid upon the medium. Usually about a dozen such plates were made. The sub-cultures were examined as to morphology and retention of Gram's stain. Those organisms which were like the dysentery bacillus in shape—that is, small, plump bacilli resembling colon bacilli and Gram-negative—were grown on various media as follows. Shake cultures in glucose agar were made for the purpose of testing for gas formation. Growth on litmus lactose agar was observed in slant tubes for control of the growth on the plates. Tests for acid formation were made in tubes of litmus mannite agar and litmus whey. Milk tubes were inoculated to test for the coagulating power. In a

few cases indol formation was tested for after a week's growth on Dunham's peptone solution. Because of lack of diagnostic significance the test was discontinued. The examination for motility was made from 18-hour growths in broth and agar slants. Mannite fermenters were tested for the fermentation of maltose and saccharose and proved to be of the Flexner-Harris type exclusively. The organisms which corresponded to the cultural characteristics of dysentery bacilli are given in Table 1. It will be seen that in 22 cases bacilli of the Shiga type were found, in nine cases bacilli of the Flexner type, and in seven cases no organisms of the dysentery type were recovered. In cases 2 and 13 both Shiga and Flexner organisms were found.

In case 9 bacilli of the cultural characteristics of paratyphoid A bacilli were found but were not identified by agglutination. In case 26 *B. pyocyaneus* was isolated. The report of an epidemic of dysentery due to *B. pyocyaneus*[1] lends interest to this finding.

The examination for amebae in the stools proved negative.

In order to confirm the diagnosis of the bacilli isolated from the stools, agglutination tests were made with serum of animals immunized to known strains of dysentery bacilli obtained from Dr. N. McL. Harris of the University of Chicago. A goat was immunized

TABLE 2.

Case No.	1–20	1–40	1–80	1–160	Control in Salt Sol.
1	+	±	−	−	−
2*b*	+	−	−	−	−
4	+	+	−	−	−
7	+	+	−	−	−
9*b*	+	±	−	−	−
11*b*	+	−	−	−	−
13*b*	+	−	−	−	−
14	+	+	−	−	−
16	−	−	−	−	−
17	+	−	−	−	−
18	+	+	+	−	−
21	+	+	+	−	−
22	+	−	−	−	−
23	Culture lost				
25	+	+	−	−	−
28	+	−	−	−	−
29	+	−	−	−	−
31	+	+	−	−	−
32	+	+	+	−	−
34	+	+	±	−	−
*C1	+	+	±	−	−
†C2	−	−	−	−	−

* C_1 = Stock Shiga bacillus.

† C_2 = Control made with colon bacilli.

to Shiga bacilli and tests were made by the macroscopic method. The tubes were incubated at 37° C. and observation was made at the end of four hours. The results are represented by Table 2.

An agglutination test was made in a similar way with Flexner

[1] Lartigau, *Jour. Exper. Med.*, 1898, 3, p. 595.

bacilli with the serum of a rabbit immunized to known Flexner bacilli (Table 3).

TABLE 3.

Case No.	1–20	1–40	1–80	1–160	Control in Salt Sol.
20.....	+	+	+	−	−
24.....	+	−	−	−	−
32.....	+	−	−	−	−
*C_1.....	+	+	+	−	−
†C_2.....	−	−	−	−	−

* C_1 = Stock Flexner bacillus.
† C_2 = Colon bacillus.

Unfortunately some of the strains of Flexner bacilli were lost and agglutination tests were possible only with part of the strains isolated.

Except in one instance—case 16—the agglutination test corresponded to the cultural diagnosis. The results, then, are in confirmation of the work of other investigators.

With the hope of ascertaining the way in which the dysentery bacilli are perpetuated in the institution, a number of bacteriological examinations were made of the stools of patients subject to recurring attacks of dysentery. These patients were free from dysentery at the time of the examination. Of seven such patients only one was found to harbor bacilli corresponding culturally to dysentery bacilli. The organism isolated from this case corresponded to the Shiga bacillus but was not agglutinated by the serum of the goat which was immunized to Shiga bacilli. The patient's serum was low in opsonins for this bacillus and did not agglutinate it in dilution of 1–20. Its identity therefore was not established. The failure to find dysentery bacilli in the stools of these cases of recurring dysentery is not to be taken as a point against the supposition that such patients are bacillus carriers. It is often extremely difficult to isolate dysentery bacilli from patients with dysentery at the time of examination, and the difficulties of isolating them from normal stools are much increased.

No attempt was made to determine the means of transmission from patient to patient in the institution, as the investigation of Dr. Pollock, resident physician in the summer of 1909, is fairly conclusive on this point. By using extreme care as to screening

and other means of avoiding flies and the protection of the food of the patients from flies, he was able to reduce greatly the number of cases of dysentery in one ward as compared with control wards where ordinary precautions were used. The time of development of most of the attacks of dysentery corresponds, moreover, to the fly season—July, August, and early September.

II. DIAGNOSIS.

Perhaps the greatest difficulty in the therapy of bacillary dysentery is the lack of an adequate means of diagnosis. On account of the rarity of occurrence of dysentery bacilli in normal stools, their recovery in diarrheal stools might be considered as diagnostic. This method however is not only uncertain but difficult and time-consuming. Deaths occur in many acute cases before the isolation and diagnosis of the bacilli can be accomplished.

Agglutinins develop too late to be of satisfactory use in diagnosis. The work of Lucas, Fitzgerald, and Schorer[1] gives a good idea of the deficiencies of the agglutination test and also a comparison with conglutination and complement fixation tests. They give the following percentages of positive findings in cases in which bacilli were isolated.

Agglutination: Flexner bacilli, 57.8 per cent; Shiga bacilli, 26.3 per cent.
Complement fixation: Flexner bacilli, 43.2 per cent; Shiga bacilli, 47.2 per cent.
Conglutination: Flexner bacilli, 60 per cent; Shiga bacilli, 21 per cent.

With the hope that the opsonic index might be of value in diagnosis, a number of cases in which bacilli were found were examined with respect to the opsonic index and agglutination reaction. The agglutination tests were carried out as in the diagnosis of the bacilli with immune serum. The opsonic index estimations were carried out with the ordinary Wright technic. The results are given in Table 4.

It will be seen from this table that the three Flexner bacillus cases gave positive agglutination reactions. One agglutinated both Flexner and Shiga bacilli; of the Shiga cases only three agglutinated the autogenous organism and two the stock bacillus. Four

[1] Lucas, Fitzgerald, and Schorer, *Jour. Am. Med. Assn.*, 1910, 44, p. 441.

of the Shiga cases agglutinated Flexner bacilli. This peculiarity has been noted before by Thomas[1] and in the Danvers report.[2]

TABLE 4.

Case Number	Type of Infection	Agglutination of Autogenous Organisms	Agglutination of Stock Shiga Bacilli	Agglutination of Stock Flexner Bacilli	Opsonic Index to Autogenous Bacilli	Opsonic Index to Shiga Bacilli	Opsonic Index to Flexner Bacilli
9	Shiga	—	—	1–20	0.45	0.66	1.0
11	Shiga	—	—	—	0.6	1.36	†
12	Shiga	1–20	1–10	—	2.	1.	0.9
13*a*	Flexner	1–20	1–20	1–20	1.4	1.6	0.7
13*b*	Shiga	1–20	1–20	1–40	1.5	...	....
14	Shiga	—	—	1–20	1.5	1.	1.1
15	Shiga	—	—	—	0.75	0.7	0.8
16	Shiga	—	—	1–40	1.5	*	1.8
18	Shiga	1–40	—	—	4.	1.6	1.4
19	Flexner	1–40	—	1–40	0.7	1.7	0.75
21	Shiga	—	—	—	0.8	0.7	0.8
32	Flexner	1–80	—	1–80	0.9	0.7	0.8

* Index high, but no accurate reading possible on account of bacteriolysis.

† No index estimated.

Excepting one case, all the cases examined showed a considerable variation from normal in the opsonic index to the stock bacilli and all showed a variation from normal in the index to the autogenous organism. If the contention advanced by the Wright school, that such variations from normal have a diagnostic value, is accepted, then we must conclude that the opsonic index is a valuable aid in diagnosis. The advantage of the opsonic index as a means of diagnosis lies in the fact that a specific change in opsonic concentration can be demonstrated in the negative phase of the process of immunity. Here we have a decrease in opsonic concentration due to specific absorption.

In the case of agglutinins we must wait until the positive phase before a specific change is demonstrable. The difference in opsonic index to autogenous organisms and stock bacilli is probably due to a difference in the virulence of the organisms. This difference in phagocytability of organisms is of interest in that it probably has a bearing on the way in which an organism is enabled to exist in the body of an individual possessing a considerable degree of immunity to the organism (bacillus carriers).

[1] Thomas, *Klin. Jahrb.*, 1909, 22, p. 29.

[2] *Loc. cit.*

The ease with which such a change in phagocytability is brought about *in vitro* is illustrated by the following experiment.

A laboratory strain of Shiga bacilli was grown on broth to which was added a small quantity of goat serum, which was bactericidal to the same strain in dilutions of 1–50. The organisms grew of course when a small enough quantity of serum was added. Now by increasing this quantity gradually, it was possible to grow the organism on increasing concentrations of bactericidal serum until it was possible to grow it on undiluted bactericidal serum.

Such an organism exhibits a high degree of spontaneous agglutination.

The readiness with which this immune organism was taken up by leukocytes was compared with the phagocytability of the strain from which it originated. For this purpose equal quantities of bacillus emulsion, serum dilution, and leukocytic suspension were used. The immune organisms had to be shaken for some time before a homogeneous suspension was obtained. The results are shown by the following figures. Immune goat serum was used.

Dilution of Serum	A	B
1–4	4	½
1–16	1	0
1–128	1	0

A represents the average number of non-immunized organisms taken up per leukocyte; B, the number of immunized bacilli.

A 24-hour broth culture of the immunized strain was filtered through a porcelain filter. A 24-hour agar culture of non-immunized bacilli was treated with this filtrate for a half-hour at room temperature and the bacilli were washed twice by centrifugation with salt solution. The bacilli so treated were compared, as to phagocytability, with untreated bacilli. As before, immune goat serum was used. The results are given in the following figures:

Dilution of Serum	Untreated Bacilli	Treated Bacilli
1–4	10	1
1–64	2	½
Salt solution	1	½

It will be seen that the substance on which the immunity to phagocytosis depends is transmitted to the culture medium, and the absorption of this substance by phagocytable organisms renders them less susceptible to phagocytosis. It will be seen that this substance bears the same relation to the "Virulin" of Rosenow[1] as a true soluble toxin does to an endotoxin. Rosenow obtains virulin only by autolysis.

III. THERAPY.

A. Prophylactic.—The results of preventive inoculations against dysentery have generally been reported as unsatisfactory. Lucksch[2]

[1] E. C. Rosenow, *Jour. Infect. Dis.*, 1907, 4, p. 285.

[2] F. Lucksch, *Centralbl. f. Bakt.*, 1908, Orig., 45, p. 365.

is the only one who reports a satisfactory result of vaccination. Shiga[1] in a vaccination of 10,000 persons reports a diminution in mortality but not in the number of cases developing. Most observers report a dangerously severe reaction, both local and general, following inoculation. Dopter[2] concludes that the only way to avoid a dangerous reaction and negative phase is by inoculation of bacilli sensitized by immune serum.

In view of the success attending inoculation against typhoid, it was thought advisable to repeat the experimental inoculation, and, in order to avoid the excessive reaction, resort was had to a preliminary very small dose, followed later by a larger one.

To study the negative phase and development of immune bodies, rabbits were inoculated with small quantities of Shiga bacilli, and the immune bodies were estimated from day to day. The results are given in Charts 1 and 2.

These curves show (1) that the negative phase must have lasted only a matter of hours, for the first estimation was made on the first day following the injection; (2) that the length of time that an increase of immune bodies is found present in the blood is not much different after three injections than after one.

It must not be inferred that immunity only lasts until the immune bodies fall to normal. In the case of the second rabbit an injection on the 36th day of two agar cultures (a dose which by control was quickly fatal) was without effect on the immune rabbit. This immunity may be explained by a changed reaction capability (allergy) or by the presence of so-called sessile receptors.

The vaccine used for preventive inoculation was prepared as follows: A mixture was made of suspensions in salt solution of 24-hour growths of the different strains of Shiga and Flexner organisms represented in Table 1. This mixture was standardized according to Wright's method and a suspension of 10 million bacilli per cubic centimeter was used for the first dose and one of 50 million bacilli per cubic centimeter for the second dose. Enough trikresol to make 0.2 per cent was added and the vaccine was sterilized 1½ hours at 60° C. The vaccine was then made into doses of 10 million and 50 million bacilli in antitoxin syringes.

For inoculation patients were selected who, so far as was possible to ascertain, had not had dysentery. The patients on one side of

[1] Shiga, *Deutsch. med. Wchnschr.*, 1903, 18, p. 327.

[2] Dopter, *Ann. Inst. Past.*, 1909, 23, p. 677.

each of three wards of the insane hospital, 62 in number, were inoculated subcutaneously with 10 million bacilli and one week later with 50 million bacilli. The patients on the other side of the

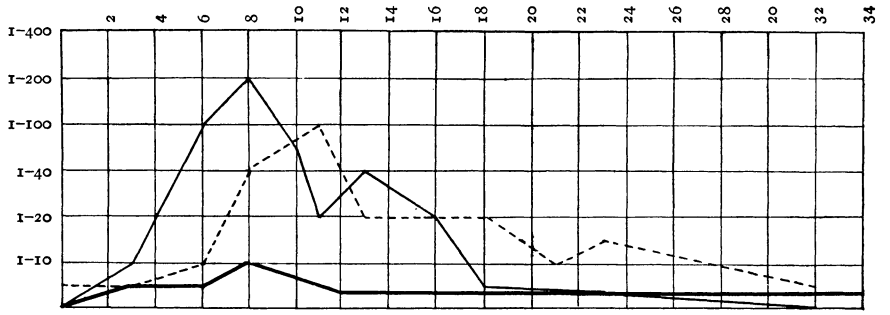

CHART 1.—Rabbit weighing 1,000 gms. inoculated with half of a 24-hour culture. The fine line indicates agglutinins, the heavy line bacteriocidins, the dotted line opsonins. The opsonins are estimated by the dilution method. The ordinates indicate the point of dilution at which opsonic, bacteriocidal, and agglutinating action disappears. The abscissae indicate the days following the injection.

In estimating opsonins and bacteriocidins, serum heated at 56° C. for a half-hour and reactivated with normal rabbit serum was used.

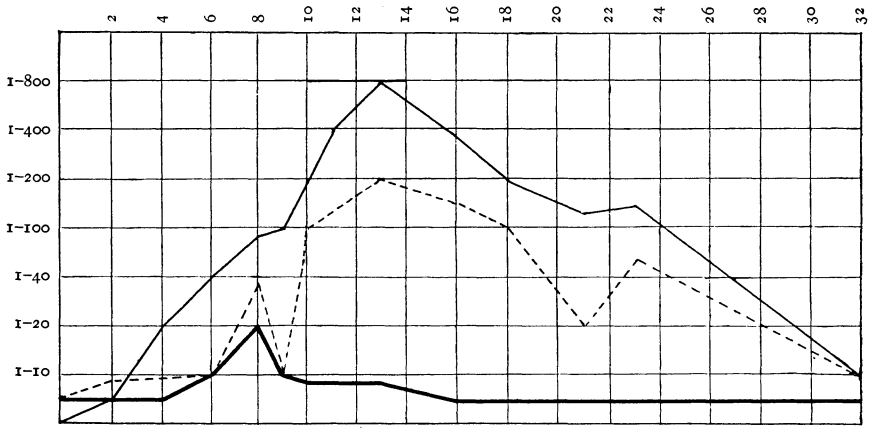

CHART 2.—This represents the result of injecting a 1,100-gm. rabbit with (1) two-tenths of a 24-hour culture of Shiga bacilli; (2) following this on the third day by an injection of half a 24-hour culture; (3) on the eighth day an injection of a 24-hour agar culture was given.

three wards, constituting about the same number, were used as controls.

Of the control patients four developed dysentery. In three of these cases Shiga bacilli were isolated, and in one, the Flexner

bacillus. Of the vaccinated patients, one developed a Shiga bacillus infection the second day after the first inoculation. The course of this case was abortive in type, lasting only 48 hours. Three of the vaccinated cases developed rather severe local reactions with some swelling and induration. Two cases had a slight rise in temperature with loss of appetite, nausea, and vomiting on the day following. These reactions occurred after the second injection.

The development of immune opsonins and agglutinins after the vaccination was observed in two cases given in Table 5.

TABLE 5.

EFFECT OF VACCINATION ON OPSONIC INDEX AND AGGLUTINATION.

CASE NUMBER	SERUM TAKEN BEFORE FIRST VACCINATION				SERUM TAKEN 9 DAYS AFTER SECOND VACCINATION			
	Agglutination		Opsonic Index		Agglutination		Opsonic Index	
	Shiga Bacillus	Flexner Bacillus	Shiga Bacillus	Flexner Bacillus	Shiga Bacillus	Flexner Bacillus	Shiga Bacillus	Flexner Bacillus
1.....	—	—	1.3	1.1	—	$\frac{1}{40}$	6	11.2
2.....	—	—	1.2	0.1	—	$\frac{1}{80}$	8	12.8

Owing to the fact that only a few of the control cases developed dysentery, a second series of vaccinations was made by Dr. Pollock. In this series half the patients in a ward of 70 were inoculated. The ward was selected for the reason that it was particularly hard to rid of flies, and dysentery cases were frequent. In view of the fact that rather severe reactions followed the injection of the second dose of 50 million bacilli in the first series, only one dose of 15 million was given in the second series. In this series there were three cases of dysentery in the controls and none in the vaccinated cases.

The conclusion would seem justified that the prophylactic inoculations were successful in immunization during the period of observation. In the first series this was about four months; in the second series, about one month. Observation was continued until November, when the development of dysentery became very infrequent.

B. Curative inoculations.—A number of cases were injected subcutaneously with small doses of killed bacilli. For this purpose

autogenous organisms were prepared in a way similar to that described for the preparation of vaccine for preventive inoculation. The treatment was carried out by the physicians in charge of the cases and reports were made as to the results. The numbers refer to the cases of the same number in Table 1.

Case 4. Diagnosis, pellagra. Dysentery about one week. Received five million bacilli and a second dose of 10 million three days later. The dysentery patient gradually improved and recovered in the course of about a month. No beneficial effect of the vaccine could be inferred.

Case 7. Diagnosis, dementia praecox. Dysentery about two weeks. An initial dose was followed the next day by marked improvement in the diarrhea, and in a few days the stools became normal. A second injection was made on the third day, after the first. Ten million bacilli were given in the second dose.

Case 9. Patient with general paresis and a terminal dysentery. A dose of five million bacilli was given in the hope that the patient would live long enough to observe the effect. Death however occurred in about 18 hours.

Case 11. Diagnosis, general paresis. Patient had had dysentery for three weeks. An initial dose of five million was followed in 24 hours by so marked an improvement that no further injection was thought necessary. One week later a relapse took place. The patient again received an injection of 15 million. There was again a marked improvement the following day and the diarrhea cleared up. No further relapse occurred.

Case 13. Diagnosis, dementia paralytica and pellagra. Complete perineal tear with infection. The patient was in very bad condition. Dysentery of some weeks' duration. An injection of five million bacilli was given and three days later one of 10 million. After the second injection there was an improvement in the diarrhea, but the patient died a few days later.

Case 16. Diagnosis, pellagra. Dysentery severe for a week. Injections of five, 10, and 20 million bacilli given together with a second organism recovered from the stools. The third injection was followed by marked improvement, both in the diarrhea and in general condition. A fourth injection of 20 million was given after the stools became normal, about the seventh day. Some weeks later the patient again developed a diarrhea and death occurred in about 24 hours.

Case 17. Diagnosis, pellagra. An initial dose of 10 million was followed by a marked improvement in about 24 hours and the diarrhea had cleared on the second day following the injection.

Case 18. Diagnosis, pregnancy, exhaustion psychosis, pulmonary tuberculosis. Dysentery of five days' duration. Dose of 10 million bacilli. This was followed by an improvement the next day. After a few days, however, the patient died of pulmonary hemorrhage.

Case 20. Diagnosis, psychosis. Dysentery for two weeks. Given 10 million bacilli. Improvement in 24 hours. Recovery.

Case 21. Chronic dysentery of a duration of several months. Initial dose of 10 million bacilli followed by increasing doses of 15, 20, 50, and 100 million with gradual improvement. The doses were given at intervals of four days. Recovery in about three weeks.

Case 28. Chronic dysentery; patient extremely emaciated as a result of a dysentery of several months' duration. Improvement after three injections at intervals of three days: first, 10 million; second, 20 million; third, 40 million. Recovery.

Case 29. Diagnosis, dementia praecox. Dysentery five days. Vaccination with 10 million bacilli. Improvement in 24 hours. Recovery.

Case 31. Chronic dysentery with a duration of over six months. The patient was given doses twice a week beginning with 10 million and increasing by double the dose each injection until 80 million were given. Then injections of 100 million for three weeks at intervals of one week. Recovery after about six weeks.

Case 32. General paresis. Dysentery of two weeks' duration. A dose of 10 million bacilli was followed in 24 hours by improvement and recovery in a few days.

From these case reports the conclusion might be drawn that the vaccine treatment is much more valuable than is really the case.

It will be noted that all of the cases treated were of some days' duration. Many of the cases were of the fulminating type and death occurred before autogenous vaccine could be prepared. As a result this vaccine treatment was tried only on cases in which the chance of spontaneous recovery was good. This fact, taken with the extreme variation in the course of the disease, renders conclusions somewhat difficult. The regularity of the period after which improvement began after vaccination (24 to 48 hours) would indicate that in these less acute cases the treatment had a beneficial effect. That this improvement was observed in case 11, both after the primary attack and after relapse, favers this conclusion.

A preparation of stock vaccine similar to that used in prophylactic vaccination was used in treatment of a few of the cases, but was without effect.

An examination of the serum of case 21 before and after recovery shows an increase of opsonic index from 0.8 to the autogenous Shiga bacillus to 2.5 and from 0.7 to stock Shiga bacillus to 2.1.

CONCLUSIONS.

The dysentery in the Cook County Institutions at Dunning is of the bacillary type. Shiga bacilli predominate.

The transmission and spread of infection is probably by means of indirect contact and fly transmission.

The perpetuation of infection may be by means of bacillus carriers.

The value of the opsonic index as a means of diagnosis in dysentery of the bacillary type deserves further investigation.

The preventive inoculation of killed dysentery bacilli is a valuable aid to prophylaxis. The curative treatment by means of vaccine deserves further investigation.